Dark Energy Inhomogeneity and SNAP

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Cosmological constant

- $w = -1$
- constant in time
- homogeneous in space

Dark Energy

- $w \neq -1$ (may be close today)
- EOS possibly varying in time (may be ∼constant today)
- inhomogeneous in space (by Equivalence Principle)

So inhomogeneity/anisotropy key distinguishing feature.

Should SNAP look over more widely spread fields to try constraining dark energy inhomogeneity?

No, neither SNAP nor other planned experiments would detect it.

Dark Energy $\sim$ very light mass scalar field

$$\text{mass} \sim 1/[\text{Compton wavelength}] \sim \sqrt{V_{,QQ}}$$

No clustering on smaller scales, cf. neutrino HDM.

$$m \sim 10^{-33}\,\text{eV}, \qquad \lambda_Q \sim H^{-1}$$

Observation: CMB measurements of ℓ_A show no anisotropy. *More precise measurements than SNAP don't detect it.*

Theory:

- Amplitude of Q inhomogeneity $\approx 10^{-5}$ at horizon crossing like all else.
- Inhomogeneity can't grow until dark energy dominating.

Anisotropy likely to be very small today.

Experiment:

- 180° and $< 5°$ anisotropy can still be searched for.
- Mission difficulties in pointing all over sky – spacecraft motion, sun shielding, galactic extinction, etc.
- Weak lensing science details prefer contiguous wide area field not small isolated patches.

No science advantage but mission disadvantages to spreading survey fields.

Current SNAP field geometry offers superior science, mission.

Searching for dark energy inhomogeneity is not appropriate for SNAP.

Small hope of detecting it in far future combination all sky CMB and lensing surveys.